

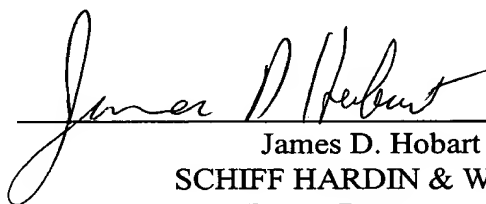
REMARKS

Claims 1-10 are presented for examination.

By this amendment, the specification has been replaced by the attached Substitute Specification. A marked-up copy of the specification is attached herewith
5 as an Appendix. Claims 1-5 have been amended to place them in form for examination in the United States Patent Office and to remove multiple dependency. A marked-up version of claims 1-5 is also attached herewith in the Appendix, with insertions being underlined and with deletions being in brackets. In addition, claims
10 6-10 have been added to cover the possibilities of the multiple-dependency of original claims 4 and 5.

It is respectfully submitted that these amendments do not change the allowability found in the Preliminary Examination Report of March 13, 2001.

Respectfully submitted,

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A P P E N D I X

Version with markings to show changes made.

IN THE CLAIMS:

--1. (Amended) A device for placing flip chips [(6)] on a substrate [(8)] in the form of a leadframe, the device [having] comprising a movable placement head [(1)], which picks up the flip chips [(6)] from a stock of components [(for example 5)] and places them on the substrate [(8)], [characterized in that] the placement head [(1) is] being provided with a turning device [(9)] for the flip chips [(6)], [in that] the placement head [(1) is] being provided with a multiplicity of grippers [(4)] circulating in a turret-like indexed manner, [in that] the turning device [(9) is] being assigned to a stationary part [(for example 2)] of the placement head [(1)], [in that] the turning device [(9) respectively takes over] taking one of the flip chips [(6)] in a first holding station of the grippers [(4)] and [returns it,] after turning the chip, returning the turned chip to one of the grippers [(4)] in one of the downstream holding stations.--

--2. (Amended) The device as claimed in claim 1, [characterized in that] wherein the turning device [(9)] has two pivotable holders [(7)], one of [which] the two holders can be aligned with the first of the holding stations, [in that the] and a second holder [(7)] of the two holders can be aligned with a downstream one of the holding stations and [in that] wherein the two holders [(7)] can be pivoted into a mutual transfer position, in which their ends, carrying the flip chip [(6)] and projecting toward each other, are aligned with each other.--

--3. (Amended) The device as claimed in claim 2, [characterized in that] wherein the holders [(7)] are designed as pivotably mounted suction pipettes, [in that] wherein the grippers [(4)] are designed as suction grippers protruding radially from the placement head [(1)], [in that] wherein the holders have pivoting axes [(10),] extending perpendicular to [the] a turning plane of the grippers [(4), of the holders (7) are] and being arranged [in] on axial [extension] extensions of the grippers [(4)] and [in that] wherein longitudinal axes of the holders and of the

grippers are in line with one another during the transfer [between them] of the flip chips therebetween.--

--4. (Amended) The device as claimed in [one of the preceding claims, characterized in that] claim 3, wherein a clearance between the holders [(7)] directed oppositely facing each other and in line with each other in the transfer position [there is a clearance, which] is somewhat larger than the thickness of the flip chips [(6)].--

--5. (Amended) The device as claimed in [one of the preceding claims, characterized in that] claim 4, wherein the first and [second] downstream holding stations are arranged immediately following each other.--

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~~Description~~

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TITLE

Device for placing flip chips on a substrate

BACKGROUND of the INVENTION

- 5 The invention relates to a device for placing flip chips on a substrate ^{or base} in the form of a leadframe. The device [having] ^{has} a movable placement head, which picks up the flip chips from a stock of components and places them on the ^{base or} substrate.
- 10 Flip chips of this type are usually presented with their connection elements pointing upward. What are known as wafer handlers are provided with a turning device for the flip chips, so that the placement head,
- 15 which can move in a placement plane, of a placement device can pick up the flip chips in their correct insertion position and place them onto a printed-circuit board at the intended ^{position} for this purpose.
- 20 The flip chips are presented, for example in accordance with JP 161027 A (cf. Patent Abstracts of Japan, vol. 13, No. 270, of July 21, 1989), in a wafer with their connection elements pointing upward. A movable removal head of a wafer handler removes the flip chips from the
- 25 wafer and deposits [them] ^{the chips} on a stationary turning device, by means of which [they] ^{the chips} are deposited in a turned position on a transfer station, from which the removal head picks them up and places them in the correct insertion position with the connections downward onto a
- 30 semiconductor substrate, which is usually in the form of a strip-like leadframe for the production of packaged components and is passed through the placement station in a cyclical manner.
- 35 ~~Furthermore,~~ US 5 839 187 discloses a device for the handling of flip chips, in which the flip chips are removed from a wafer by means of a gripper. The gripper is pivoted about a horizontal axis and, turned

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in a transfer station ^{to insert the chip which is then} transferred to a positioning gripper, which deposits the flip chips into a flat magazine.

- 5 ~~Furthermore~~ US 5 667 129 A (claim 7) discloses a placement head for placing flip chips on a substrate, ~~and~~ the placement head ^{has} having a turning device (not represented in any more detail) for the flip chips.

Summary of the Invention

- 10 The invention is based on the object of reducing the complexity of a device for the placement of components on the substrates.

Insert A (from page 2a)

- This object is achieved by ~~the invention according to~~
 15 ~~claim 1.~~ ^P The freely positionable placement head can be moved in a positioning system in such a way that its range of movement covers the entire area of the wafer and the fixed substrate, for example in the form of a printed-circuit board. The placement head can
 20 therefore remove the flip chips directly from the wafer, move over ^{to} the substrate, turn ^{the chip} in ~~its~~
^{the} accompanying turning device in the time between the pickup and placement on the substrate and, after turning ^{the chip}, place the flip chip ~~s~~ onto the substrate. This
 25 measure allows all the essential functions of the pickup, transportation, turning and placement of the components to be carried out with a single handling system in a time-saving manner, ^{and makes} ~~making~~ it possible to dispense entirely with the wafer handler. The use of a
 30 turret placement head ~~X~~ makes it possible to pick up a multiplicity of flip chips in rapid succession from the wafer and turn them between two holding stations. Subsequently, the multiplicity of flip chips held on the grippers are placed on the substrate in just as
 35 rapid succession. This ^{considerably} ~~reduces~~ the number of movement operations, ^{reduction} ~~considerably~~, which is accompanied by a corresponding time saving. The placement head also has the advantage that a single turning station is required

for all the components held on the grippers and that the respective gripper does not have to wait for the complete turning operation, but instead the component

Insert
A.

a device which has a movable placement head which has a ~~rotatable~~ Turret with a plurality of grippers mounted for rotation on a stationary part, which has a turning device adjacent the path of movement of the grippers. The turning device takes a chip from a gripper in a first holding station, turns the chip and returns the turned chip to a gripper down stream of the first holding station.

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is passed on to the next station as ~~it~~ ^{the component} is turned and can be picked up again ~~there~~ ^{there} without losing any cycle time.

5 ~~Advantageous developments of the invention are~~
~~characterized in claims 2 to 5.~~
 with ~~of the turning device having~~ ^{Two pivotable holders with one aligned}
 The first holding station and ~~the other~~ ^{aligned with a downstream station and}
 The development according to claim 2 realizes the
 turning device in a simple way with few additional
 10 elements.

^{Insert B from page 3a.}
 The development ~~according to claim 3~~ allows flip chips
 to be safely transferred between the various suction
 surfaces.

15 ^{Insert C from page 3a}
~~of the holder gripping portion of the holder which is to~~
 The development ~~according to claim 4~~ allows flip chips
 of different thicknesses to be handled without
 readjustments.

20 ^{of the first and second holding stations being adjacent}
 The development ~~according to claim 5~~ allows the turning
 device to be of a compact and lightweight design.

The invention is explained in more detail below on the
 basis of an exemplary embodiment represented in the
 25 drawing.

Brief Description of the Drawings

Figure 1 shows in a schematized form a side view of a
 placement head for flip chips;

30 Figure 2 shows another side view of the placement head
 according to figure 1; and

Figure 3 shows a detail of the placement head
 according to figure 1 in another working
 35 phase.

Description of the Preferred Embodiment

According to figures 1 and 2, a turret-like placement
 head 1 has a stator 2 and a rotor 3, on which a

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multiplicity of radially protruding grippers 4 are arranged in a circulating manner. The placement head 1 is freely positionable in the direction of the perspectively represented arrows X and Y in a plane 5 parallel to the wafer ² and the substrate. ³ In the position represented in figure 1, it is located over a

Insert B

of the gripper being suction gripper extending radially from the turret and the two holders being suction pipettos mounted to pivot on axis extending perpendicular to the radially extending gripper and engaged on an axial extension of the gripper.

Insert C

of the grippers, ends of the holders while in the transfer position being spaced apart a distance greater than the thickness of the flip chip

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wafer 5, on the upper side of which flip chips 6 are presented close together in rows with their connection side ^{facing} upward ~~upward~~ ^{upward}.

- 5 The gripper 4, located in the lower turning position, is directed at one of the flip chips 6 and can be telescopically lowered onto it. ^{The} ~~said~~ flip chip is sucked onto the end of the gripper and lifted together with the latter off the wafer 5. By moving the
- 10 placement head 1 and turning the rotor 3, all the grippers 4 can be successively loaded with the flip chips 6. One of the holding stations of the grippers ^{which is shown as gripper 4a} 4 is assigned a first holder 7, which is aligned by its end with the end of the gripper 4a.
- 15 The flip chip 6 sucked onto the gripper ^{4a} can then be transferred to the holder 7 and sucked onto the end of the latter. By pivoting ^{the holder 7} into a transfer position, represented by dash-dotted lines, the flip chip 6 can
- 20 be transferred to a further ^{a second} holder ^{7a} which is directed oppositely facing the first holder and which then takes up the flip chip 6 on its connection side ^{or gripper 4b}. The second holder ^{7a} is assigned to a downstream holding station of the placement head 1 ^{which has gripper 4b}. It can be pivoted out of the
- 25 transfer position into a delivery position, which is in line with the gripper 4b of the second holding station and in which the gripper 4b receives the component on its upper side, facing away from the connection side.
- 30 In figure 3 it is shown how the flip chip 6 can be transferred between the holders ^{7a and 7a'} and turned in a time-saving manner during the rotation of the rotor 3.

- After the turning of the flip chips 6, they are
- 35 successively transported into a placement position, represented in figure 2, in which they can be placed in the correct position onto a substrate ^{or base} 8 to be provided with placed components.

I claim,
~~Patent claims~~

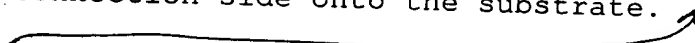
1. A device for placing flip chips (6) on a substrate (8) in the form of a leadframe, the device having a movable placement head (1), which picks up the flip chips (6) from a stock of components (for example 5) and places them on the substrate (8), characterized in that the placement head (1) is provided with a turning device (9) for the flip chips (6), in that the placement head (1) is provided with a multiplicity of grippers (4) circulating in a turret-like indexed manner, in that the turning device (9) is assigned to a stationary part (for example 2) of the placement head (1), in that the turning device (9) respectively takes over one of the flip chips (6) in a first holding station of the grippers (4) and returns it, after turning, to one of the grippers (4) in one of the downstream holding stations.
2. The device as claimed in claim 1, characterized in that the turning device (9) has two pivotable holders (7), one of which can be aligned with the first of the holding stations, in that the second holder (7) can be aligned with a downstream one of the holding stations and in that the two holders (7) can be pivoted into a mutual transfer position, in which their ends, carrying the flip chip (6) and projecting toward each other, are aligned with each other.
3. The device as claimed in claim 2, characterized in that the holders (7) are designed as pivotably mounted suction pipettes, in that the grippers (4) are designed as suction grippers protruding radially from the placement head (1),

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Abstract of the Disclosure

~~Device for placing flip chips on a substrate~~

A freely positionable placement head ~~is~~ removes presented flip chips ~~from~~ from a wafer ~~with~~ the connection side of said chips being directed upward. The placement head has a turning device ~~in~~, in which, by the time they are placed onto a substrate ~~to~~ to be provided with placed components, the flip chips are turned in such a way that they can be placed with their connection side onto the substrate. 

This makes it possible to dispense with a complex turning device assigned to the wafer ~~is~~.

~~Figure 1~~

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